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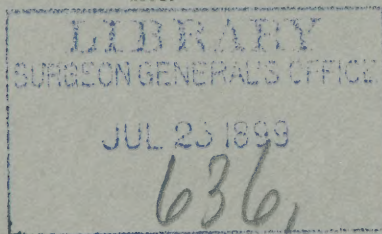
THE IMMEDIATE CORRECTION OF THE DEFORMITIES
RESULTING FROM POTT'S DISEASE.

BY

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From the
Transactions of the American Orthopedic Association.
1898.



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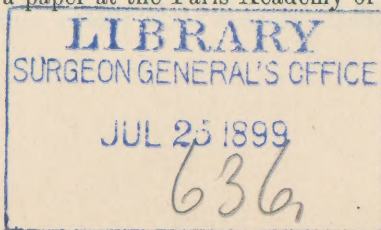
By JOEL E. GOLDTHWAIT, M.D.,
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UNTIL recently the essential part of the treatment of Pott's disease or caries of the spine consisted in fixation of the spinal column. No attempt at the reduction of the existing deformity was made, the desire being to relieve the irritation as much as possible by means of the fixation, and to prevent an increase in the projection of the bones. To accomplish this result various forms of apparatus have been devised and various methods of treatment have been suggested, but with all, while occasionally no further increase has shown, and even in rare instances while a diminution in the projection has resulted, still, in the large majority of cases, in spite of the most careful attention and without regard to the method of treatment, the deformity has increased. The presence of this deformity has been considered a necessary part of the disease, and if it has been possible to carry the patient through to convalescence with only a moderate increase of the deformity the result has been considered satisfactory.

In 1890 Dr. Hadra, of Galveston, Tex., presented a paper at the meeting of the American Orthopedic Association in which he reported a case of fracture of the low cervical spine in which he had corrected the position of the head and maintained the position by wiring the spinous process of the cervical vertebræ. He also advocated this procedure in spinal caries, but reported no cases.

In 1895 Chipault reported a series of cases of Pott's disease in which the deformity was forcibly reduced with the patient under the influence of an anæsthetic, and not only were the spinous processes wired, but the transverse processes as well.

In 1896 Calot presented a paper at the Paris Academy of Medi-



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cine, reporting a series of cases in which the deformity was forcibly reduced, and as a part of the procedure, in some of the cases, the spinous processes were excised.

Since then both of these writers have made other contributions, reporting large numbers of cases, and with both, in the later writings, the cutting part of the operation has been practically given up, the whole procedure consisting of the forcible reduction of the deformity by means of traction and pressure over the prominence.

Since the appearance of the first communication from these two writers numerous other surgeons, chiefly on the Continent, have reported cases of a similar nature, and while in some of the early cases incision was resorted to with removal of or wiring of the spinous processes, the majority of the operations have consisted simply in forcibly straightening the spine.

The after-treatment in common use consists in the application of a plaster-of-Paris dressing, in which the whole body and head is included, and this is worn without changing for six months.

While for practical purposes the operation performed by Chipault and Calot is new, it is not, however, the first time that spinal deformities have been forcibly reduced. The history of medicine shows that at different periods a similar procedure has been practised by different surgeons, and it is not improbable that in days, generations or centuries ago, when reports and records of cases were not as carefully made or as common as now, the immediate reduction of the spinal deformities was not a rare operation. Hippocrates, writing five hundred years before Christ, speaks of the procedure as an old one, and reports several different methods for accomplishing the result.

One, which is termed *Succussion*, as described in the Adams translation, Sydenham edition, and in Bigg's *Orthopraxy*, consisted in putting the patient on an ordinary ladder and securely fastening the hips and legs, leaving the upper part of the body free. The ladder with the patient, feet uppermost, was then drawn up to a "tower, or the mast of a ship," and dropped. Before reaching the ground the fall was suddenly stopped, and in this way, with the head downward and the lower part of the body fastened to the ladder, the upper part, which was unattached, jerked the vertebræ apart and corrected the deformity.

Another method, also ascribed to Hippocrates and described in Bigg's *Orthopraxy*, is more suggestive of a surgical operation, and it should be said also that this is the method which was preferred by Hippocrates for "gibbosities," as the disease was then termed.

"Something like an oaken bench, of a quadrangular shape, is to be laid along at a distance from the wall (in which there had previously been scooped an oblong furrow), which will admit of persons passing around, if necessary, and the bench is to be covered with robes, or anything else which is soft, but does not yield much. The patient, after being stoved and bathed with hot water, is to be stretched upon the board upon his face, the arms being laid along and bound to the body. Next the middle of a thong, which is soft, sufficiently broad and long, and composed of two cross-straps of leather, is to be carried along across the patient's breast, as near the armpits as possible; then what is over the thongs at the armpits is to be carried around the shoulders, and afterward the ends of the thong are to be fastened to a piece of wood resembling a pestle; they are to be adapted to the length of the bench below the patient, and so that the pestle-like piece of wood resting against this bench may make extension. Another such bond is applied about the knees and the ankles, and the ends of the thong fastened to a similar piece of wood, and another thong, broad, soft, and strong, in the form of a swathe, having breadth and length sufficient, is to be bound tightly about the loins, as near the hips as possible; and then what remains of the swathe-like thong with the ends of the thongs must be fastened to the piece of wood at the patient's feet, and extension in this fashion is made upward and downward equally and at the same time in a straight line."

Still another method, as described by Jones, and also attributed to Hippocrates, is as follows: "The patient being laid on his back, a leather bottle, not inflated, was laid under the deformity and blown up by an assistant with a forge-bellows." This particular method, as might be expected, is described as not being successful.

Ambrose Paré, writing in 1647, in an article entitled "How to Restore the Spine Outwardly Dislocated," describes a method which is surprisingly similar to that followed by Calot and the French school at the present time. His method is as follows: "The vertebræ outwardly dislocated, when as they stand bunching forth, then

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is it fit to lay and stretch forth the patient upon a table, with his face downward, and straightly bind him about with towels under the armpits and about the flanks and thighs; and then to draw and extend as much as we can upward and downward, yet without violence." It also states that if traction is not sufficient two pieces of wood are to be cut out and, when padded, are to be applied over the spine, and the correction made by pressing down on these with the hands.

Other writers speak of the procedure. Joerg accomplished the result by continued traction in bed, with pressure over the hump.

However much the operation may have been performed in the distant past, certain it is that for many years or generations the treatment has consisted in fixation of the spine in the deformed position and in limiting the development of the deformity as much as possible. Braces have been devised which have attempted the reduction of the deformity; but very little, if any, improvement has been accomplished in this way, and anything like forcible correction has been carefully avoided. To Chipault and Calot must be given the credit of this present radical departure from the conservative methods which have so long been in use. In the past, at different periods separated by many centuries, a similar operation has been performed, but for reasons which, unfortunately, the historians do not supply, each time the operation has been given up, to be revived centuries later, and then, after a brief trial, to be again forgotten. At this time it would be particularly interesting if the reasons could be known why the method has so many times dropped into disuse, and one can but wonder if another generation will find the immediate reduction of such deformities a matter of history. Certainly, if we are to expect all that has been claimed by the writers who have written the most, and have advocated the method most strongly, our disappointment will be keen, and but a short time will be necessary for the whole procedure to be discarded. Few surgeons familiar with the disease are willing to believe that the correction of hump-back, which is merely a symptom of Pott's disease, and a plaster-of-Paris jacket worn for six months will make the patient well. If, however, the method is to be accepted as one part of the treatment of Pott's disease, to be used in selected cases, as other methods are used, this, together with our more perfect knowledge of mechanical

therapeutics, makes it seem probable that much good will follow, and that in a certain number of cases the existing deformity will actually be diminished, and that in most of the early cases the increase will be less than has formerly been the case.

The exact operation, as commonly performed, both in England and on the Continent, is described by Jones¹ as follows:

"Having determined to forcibly reduce the deformity in a case of Pott's disease, it is necessary to carefully prepare our patient, more especially if the plaster corset recommended by Calot be applied. For two or three days previously the patient should be dieted with a view to supplying nourishment and avoiding waste concretions. The bowels should be thoroughly well opened, so that, if necessary, abdominal pressure may be applied by the hand without risk; and, for the same reason, the bladder should be empty. It is hardly necessary to state that the skin should be deodorized and disinfected, and that the head should be shaved. In order to avoid insect life, the scalp should be treated for a sufficient time. An assistant should now prepare the traction bandage. This consists of two linen bands a yard long. The centre of one piece is placed around the occiput, the centre of the other around the chin. They meet beneath the ear on each side, and at this point are firmly fixed by safety-pins. The free ends are knotted, and an assistant takes a loop in each hand, or, more conveniently still, the loops may be attached to a crossbar of wood or other material. The linen bands must be of equal length, otherwise the head is not pulled in line with the spine. They should be fully a yard long, in order that the assistant who controls the head may be well out of the way of the anæsthetist. This traction is quite essential, as one cannot act upon the spine by manual grasp upon the head for any length of time. In addition to the assistant who controls the head, six others are needed: two for the arms, two for the legs, one for chloroform, and one to directly assist the operating surgeon. Chloroform having been administered, at a given signal traction must be exercised. If the patient be small he need not be supported by chest or pelvic rack. A child of two and a half years requires a pull of 220 kilos. before the neck is dislocated. Traction, therefore, measured if neces-

¹ Robert Jones. The Immediate Obliteration of Deformity in Pott's Disease.

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sary by the dynamometer, should be well within that strength. Roughly speaking, five men, pulling with a force that soon tires, rarely exceed 70 kilos., so that the danger of dislocation is very slight. All, however, should pull together, and there should be no jerk. This applies more especially to the assistant who controls the head. Simple traction will reduce the deformity in a large number of cases, particularly in curvatures situated high up. If it does not, direct pressure must be applied to the hump. An assistant places his hand upon the abdomen with sufficient power to feel the bodies of the vertebræ, and it is to anticipate this pressure that I have advised a careful diet and an empty bowel. This pressure on the vertebræ from the front is a check upon the surgeon who presses directly upon the hump, and who uses sufficient force to reduce the deformity, if he can do so with safety."

Such is the operation as it has been performed. The aggregate number of cases which have been operated upon in this way is quite large, and the immediate results have been surprisingly good, while the cases in which unpleasant complications have developed have been remarkably few when the amount of force used is considered.

My own work upon the subject was commenced this past winter; and at the very outset it was a matter of much surprise that the correction could be accomplished with so much ease in the majority of cases, provided the spine was bent backward at the time traction was made. It was a matter of equal surprise that it was so difficult to maintain the correction, no matter how carefully the after-treatment was managed. The position when the jacket was applied would be satisfactory, but when it was removed the deformity would be almost as bad as ever, even though the jacket retained its shape, and even though it was applied with much less padding than is recommended by Calot, who uses an inch thickness of felt all over the body. This led to much experimentation, and it was soon found that, if the patient was placed upon the back, and all the weight of the body above the thighs was borne upon a small upright which rested directly over the apex of the kyphosis, the spine could be over-extended much more than was possible with suspension or horizontal traction, and that jackets applied in this position gave more satisfactory results.

At first this method was used simply to obtain the best possible

position of the spine after the forcible straightening under ether, but it was soon found that the same apparatus could be used for the correction, and that in a surprisingly large number of cases no other force than the weight of the body was necessary to straighten and over-extend the spine. With the spine in this over-extended position the head was thrown so far back, and the body weight put so much upon the spinous and transverse processes, that it was possible to discard the helmet as a part of the support, except when the disease was situated above the fourth dorsal vertebra. In nearly all of the cases since the first, the after-treatment has consisted in the application of a plaster-of-Paris jacket carried low enough to grip the pelvis and to limit the motions of the thighs, and also high enough to prevent the shoulders from drooping forward, and the bending forward of the head.

In the early cases ether was used for the correction, but since then the work has been done entirely without anæsthetics except in cases where the disease has been of several years' duration. Cases of one and two years' duration have been easily straightened without ether, and with practically no pain or suffering to the patient.

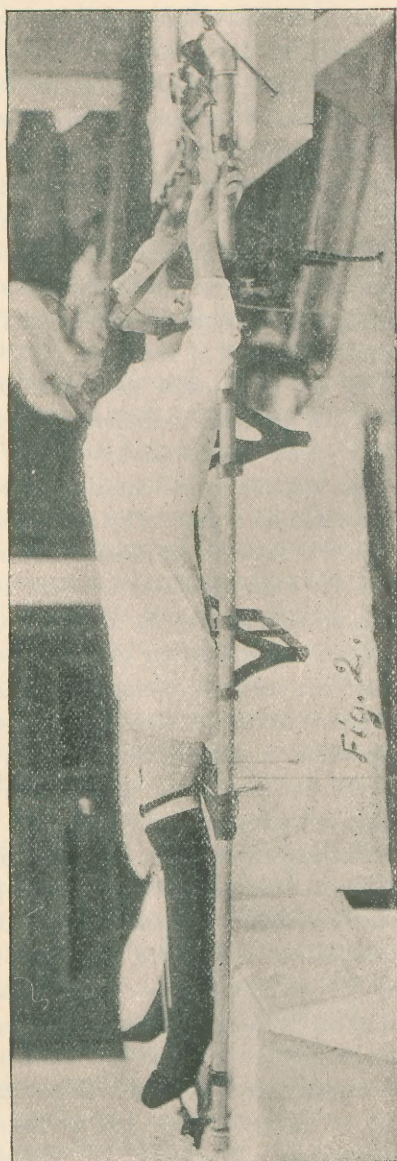
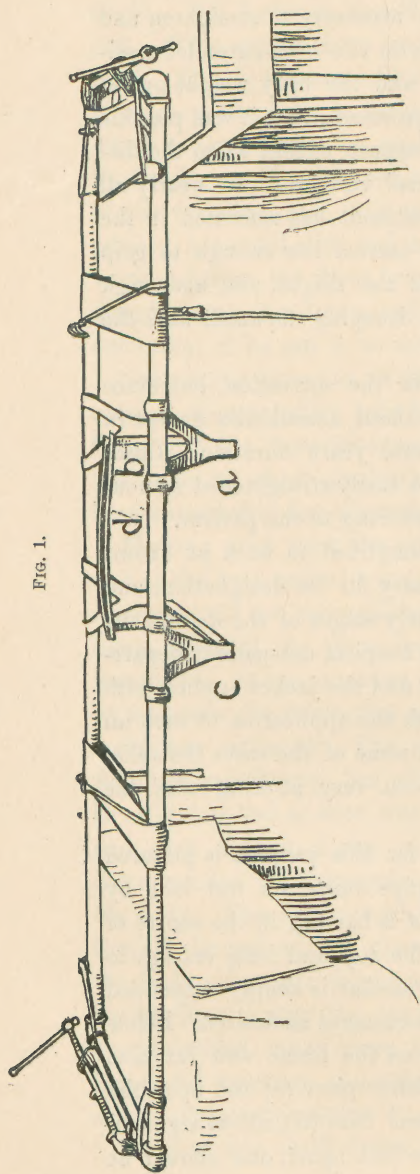
In this way the operation has been simplified to such an extent that the word operation is hardly necessary for its designation, and it is so simple that in the acute or early stages of the disease the patients are treated in the office or the hospital out-patient department, the correction being accomplished and the jacket applied with no more disturbance than is expected with the application of such an apparatus in the ordinary method. In some of the cases the relief of the existing acute symptoms has been very striking with the improved position of the spine.

The apparatus which has been used for this purpose is pictured in Fig. 1, and consists of a strong gas-pipe frame, six feet long by two feet wide. Suspended from this is a bar (*a*), in the centre of which is a vertical rod (*b*), forked at the top and long enough to reach to the level of the frame. This cross-bar is simply suspended from the frame so that its position can be changed as desired. Below this is another cross-bar (*c*), which rests on the frame and can also be adjusted as to position. Upon this latter piece (*c*) and upon the fork of the rod (*b*) rest two malleable steel bars (*d*), about eighteen inches long. These rest in grooves one inch apart, and should be

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bent to partly conform with the lumbar curve of the spine, after which they are heavily padded with felt and the patient laid upon

FIG. 1.



it, as shown in Fig. 2. The upper end of the bars (*d*) should just rest upon the fork (*b*), not projecting over, and when the patient is in position the rod (*b*) should be one inch above the apex of the deformity. The buttocks rest upon the cross-bar (*c*), and the legs are supported by one or more heavy webbing straps which can be tightened or loosened at will. No support whatever is given the upper part of the body, except that the head is steadied by the surgeon with the hand until a satisfactory amount of correction has been accomplished, and then a strap similar to those used below gives the support so that the operator's hand is free. If traction is desirable, it can be applied by means of a windlass which is attached to each end of the frame. This makes it possible to obtain much more definite and steady traction than would be possible with assistants, but its use has not been found necessary in the majority of the cases, simple over-extension of the spine accomplishing the same results.

When the maximum over-extension that is desirable is obtained, the strap under the head is fastened and the patient allowed to lie in this position while the jacket is applied. In applying this the iliac crests should be generously padded with heavy felt, and a similar pad should be placed over the upper part of the sternum, so that the jacket can be carried high up to prevent the upper part of the body with the shoulders from drooping forward. In the cases with disease in the upper dorsal region the jacket should be moulded about the anterior part of the neck so that the erect position of the head is necessary. The forked rod (*b*) is easily avoided by a few figure-of-eight turns of the bandage, so that when the plaster has set the patient can easily be lifted off, and as the rod (*b*) should be placed one inch above the apex of the deformity, this weak spot in the jacket is not objectionable.

When the patient is taken off the frame the two rods (*d*) are slipped out from below, leaving the padding in place.

As a matter of experience, it has been found necessary to practically always cut a small window over the point of greatest deformity, as otherwise when the body settles down, as is inevitable, slough will form, even though a liberal amount of padding has been used.

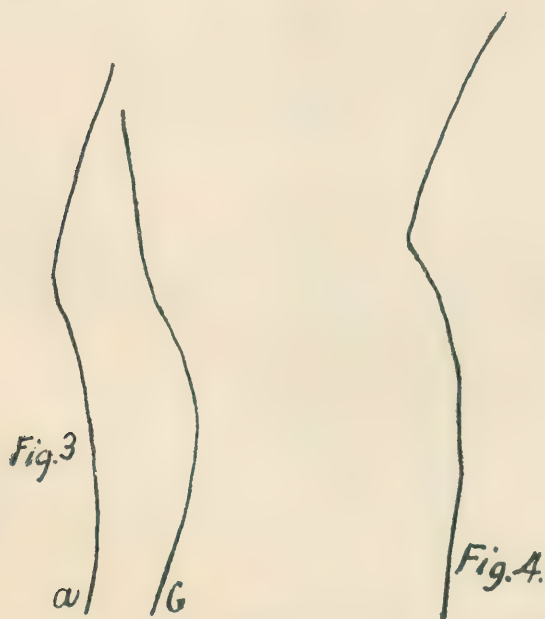
With a method so simple it would be unwise to report all of the

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cases in which it has been used, as one case does not differ essentially from another unless there be some special complication. In all, a large number of cases have been treated, and in all in which the disease has not lasted more than a year, both in adults and in children, the correction has been accomplished without ether and without suffering. In some of the cases two or three sittings have been necessary to obtain a satisfactory position, but this is true also of the method used by Calot. In the older cases, or cases of longer duration than one year, many of them have been corrected without an anæsthetic, and while with quite a number ether has been necessary for the first sitting to break up the adhesions, it was not needed at the subsequent treatments, the frame alone being sufficient to accomplish the result.

A few cases reported with some detail may be of interest by way of illustration.

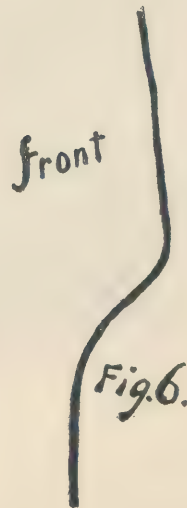
CASE I. A girl, aged five years, was brought to the Children's Hospital in March, 1898, because of a bunch in the back, said to



have been present for two weeks. The extent of the deformity is shown by the tracing, Fig. 3, *a*. The child was put upon the frame, and just before the jacket was applied the tracing shown in Fig. 3, *b*, was taken. During the whole treatment not a cry or complaint was made by the child.

CASE II. A boy, aged five years, who had a marked knuckle, as is shown in Fig. 4. The child was put upon the frame, and, without ether and without pain, the position shown in Fig. 5 was obtained.

CASE III. A girl, aged eleven years, who had had Pott's disease for three years and had worn a brace for over two years. In Feb-



ruary of this year the position of the spine was as is shown by the tracing, Fig. 6. When put upon the frame, without ether and without pain, the spine was straightened, as is shown in Fig. 7.

CASE IV. A boy, aged nine years, had had Pott's disease for over three years, with steadily increasing deformity, in spite of care-

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ful mechanical and general treatment. The general condition had been steadily growing worse, and for this reason the correction of the deformity was attempted. The condition just before the operation is shown in Fig. 8. Ether was used for the first correction, but for the subsequent treatments the frame alone has been all that was necessary. The improvement in the child's general condition after the correction has been very striking, due, apparently, very largely to the better opportunity for deep respiration. The con-



Case III.



Case IV., before operation.

dition three weeks after the operation is shown in Fig. 9, and nine weeks from that time, or twelve weeks from the operation, is shown in Fig. 10. The improvement in position between these last two photographs is quite noticeable, and illustrates the gain which can be made from time to time as the jackets are changed. There has been no pain from the first, and the child has been up and about, with the exception of the first two weeks.

As to the age of the patients, most of them, naturally, have been children, the youngest, and this one corrected without ether, being

four years of age, while the oldest patient was a man of thirty-five. No unpleasant results have been experienced, while in practically all of the cases the symptoms have been relieved, and the paralysis which was present in five of the cases disappeared almost at once.



Case IV., three weeks after operation.



Case IV., twelve weeks after operation

In one case there was an abscess, which had been discharging for some time. No unpleasant symptoms developed, and the course of the abscess has not been noticeably changed by the treatment. This is given as a contraindication for the operation by some of the writers, yet it does not seem to me that the risk is materially increased, provided there is a free outlet for the discharge. On the other hand, there must always be some risk, and a very considerable risk, especially if much force is used, from the possibility of rupturing a small beginning abscess too deeply seated and too small to be detected by examination.

The effect of the correction upon the paralysis has been most interesting, and in the five cases with this complication the improvement has commenced almost immediately after the spine has been straight-

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ened. Other observers report similar results without much regard to the exact method by which the correction has been accomplished.

This experience would seem to show that, in spite of the varying theories as to the cause of the paralysis, pressure must be the most important element, and that there can be little, if any, degeneration of the nerve-cells or fibres, as restoration of motor control has been at times immediate. In my own cases the improvement occurred at once in two cases, both adults, with whom the correction was performed without ether, the power returning while the patient was upon the frame during the straightening. One of these was particularly striking, and beginning with almost complete loss of motor control of the legs, as well as the bladder and the rectum, as the spine straightened he was able to move the legs. These cases are so striking, and contrast in such a marked way with the results obtained by the ordinary methods of treatment, that a report of the separate cases is offered.



CASE I. A young woman, aged twenty years, had had Pott's disease for between three and four years, and, in spite of treatment,

the deformity had increased to the extent shown in the tracing (Fig. 11). Paraplegia developed nearly two years ago, and after recumbency for one year there was a partial return of power of the legs, and the patient was allowed up, wearing a leather jacket. The improvement continued for two or three months, and then the paralysis returned, so that the bed was again resorted to. The early part of this year the patient was admitted to the Carney Hospital, and under either the spine was straightened and a plaster-of-Paris jacket applied. The next day (the muscles were not tested on the same



day) there was quite perfect voluntary control of the legs. The patient remained in bed for about four weeks, and was then allowed up. Even though the control of the muscles of the legs returned, the exaggeration of the knee reflexes and ankle clonus persisted for two or three months, although this was not marked enough to interfere with walking. This has disappeared, apparently, as the muscular strength has returned. The patient now walks easily, and without other peculiarity to the gait than would be shown by any

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one with whom the spine was held rigid. (Fig. 12 shows the position at the present time.)

CASE II. A man, aged twenty years, was seen first in November, giving a history of spine trouble of five or six months' duration. Paralysis developed after two or three months of treatment, and for this the patient was put to bed, but after two months, there being no improvement, he was admitted to the Carney Hospital. At that time there was not only complete loss of power in both legs, but also paralysis of the bladder and rectum.



Case II., before operation.



Case II., four weeks after operation.

On March 14th, without ether, the spine was straightened upon the frame, and as it straightened the power to move the legs returned. No discomfort whatever was felt by the patient during the treatment, except a momentary sense of suffocation as the straightening commenced. When fully straight, breathing was easier than it had been previously. Since then there has been a gradual improvement in the strength of the legs and in the ability to get about.

(Fig. 13 was taken just before the operation, and Fig. 14 about four weeks after.)

CASE III. A boy, aged eight years, had disease in the upper lumbar region which had been under treatment for one year. There was only a slight projection of the spine, and during the year there had been practically no increase. In March of this year paralytic symptoms developed in both legs. After a month of bed treatment, during which time there had been no noticeable improvement, the spine was over-extended without ether and a plaster-of-Paris jacket applied. Following this there was very marked improvement, and at the end of two weeks the child was allowed up, and has continued to do well since. The exaggeration of the reflexes has entirely disappeared.

CASE IV. A man, aged twenty-seven years, was first seen in November, 1897, with Pott's disease in the dorsal region, of one and one-half years' duration. At the time of the first examination the knee-jerks were markedly exaggerated and a distinct ankle clonus was present. These symptoms increased so that walking was difficult, and in the following month the patient entered St. Margaret's Hospital, and without ether a correction of the deformity was attempted. The jacket was applied lying on the face on a hammock, and served to hold the spine quite well for a few days, but after that the body seemed to settle into the jacket and the paralysis, which had been relieved, returned. This was repeated for two or three times, each jacket being followed by some improvement, but of short duration.

After this the patient was sent home and kept in bed; in spite of which the paralysis increased, so that there was practically no control of the legs. The bowels were also involved, and dejections were impossible without assistance.

On April 7th the patient was again admitted to the hospital, and by means of the frame, which had been perfected since the first treatment, the spine was straightened, and a jacket applied holding the over-extended position. While on the frame there was a partial return of the voluntary control of the legs, more perfect on the left side. Since then two other jackets have been applied, each being followed by a gain in the use of the legs; so that at the present time

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the patient is able to walk about very easily, and the bowels, for which cathartics had been necessary for several months, have moved regularly without any assistance whatever since the spine was straightened.

CASE V. A man, aged thirty-six years, with dorsal Pott's disease, which had not been recognized until the time of the first examination, in April last. My advice had been asked because of a right-angled deformity of the right knee as the result of an old tumor albus. At this time both legs were paralyzed. The treatment was imperfectly carried out, owing to the fact that the patient lived at a distance from the city and it was necessary to use an improvised apparatus; nevertheless, with the imperfections, a marked gain in motor control of the legs resulted.

The results in these cases are in marked contrast with the results obtained by recumbency, which has until now been the accepted method of treatment.

In Myer's series of 270 cases the average duration of the paralysis, in the cases in which recovery took place, was as follows: in the cervical region, twelve months; in the upper dorsal region, nine and a half months; in the lower dorsal region, six months; and in the lumbar region, eight months.

My own experience has been similar to this series, as the paralysis has been seen in children. In adults the duration has been much longer, and from eighteen months to two years has been more nearly the average time required for recovery.

The immediate results in such a series of cases are so strikingly satisfactory that the ultimate condition of the patients is apt to be overlooked, and in the first enthusiasm over the operation the exact pathology of the disease seems to have been forgotten. Certain it is that the deformity can be reduced in a large number of cases, but the fact remains that the cause of the deformity is the destruction of a considerable portion of one or more vertebræ as the result of tubercular disease. It is also well known that bone repair in this disease takes place much more slowly and less completely than in the other forms of bone disease. Also, it is well known that the reparative process in the bone can take place only after the tubercular granulations have been absorbed, a matter always involving

many months or years; and what is also an important factor is that, as the bone-forming elements have been so largely destroyed by the disease, the amount of new bone formed must be slight and wholly inadequate to fill the large gap that would be left after the treatment in the severe cases. Claims have been made that bone repair has taken place very rapidly after the operation, and Calot and Ducroquet both present radiographs which are intended to prove this. The reproductions from these, however, are very far from satisfying, and one must be decidedly doubtful when it is realized that all of the pathological material which it has been possible to study shows little, if any, attempt at the formation of new bone. As tuberculosis of the spine is not essentially dissimilar from tuberculosis of the other bones and joints, and as the pathological condition found in the specimens which have been examined is entirely similar to the condition found after like treatment in other joints, it is probable and reasonable to suppose that the process of bone repair has not been radically changed by mere forcibly straightening the spine.

The immediate results of the work are most striking; but if this is to be the chief purpose, and unless the after-treatment is carried on most patiently and intelligently for years afterward, certain it is that the ultimate results will be as disappointing as the first results have been gratifying, and that relapse will be the rule. Already relapses have been reported by Péan, Phocas, Tansch, Lorenz, and Vincent, and many others must follow, if a few months of after-treatment, as Calot would have us believe, is all that is necessary to accomplish a cure. It must be remembered that simple straightening of the spine does not materially alter the course of a tubercular disease. It may be slightly modified in some regards, but the disease is still the same.

Much good, however, will certainly follow the introduction of this method, and it will undoubtedly have its place as a part of the treatment of Pott's disease; and as the result of it in the future, humpbacks will, in all probability, be less common.

From my own experience, it seems to me that the chief place for the operation is in the very early stages of the disease, before extensive destruction of the bone has taken place. In these cases, instead of fitting apparatus to hold the bones in the deformed position, the spine should be over-extended and the jacket or the appa-

ratus applied in this position. By doing this the weight is removed from the bodies of the vertebræ as much as possible, and the irritation due to the diseased bones rubbing together is very largely relieved. It is reasonable to suppose that, as a result of this, the course of the disease will be somewhat shortened, and that the destruction of the bone and consequent production of deformity will be lessened.

In the cases in which there is paralysis the operation is, without question, the best treatment; and in a certain number of other cases in which there is marked deformity, with the narrow chest and poor general condition, and where the deformity is increasing, the operation should be undertaken. In this latter class the general condition is improved by the more erect position, with the freer chest movement, so that the vital resistance is increased. In these cases the support should be worn until the patient has attained the full growth, and then when removed the relapse or the development of the deformity will be comparatively slight, as the ribs will then be firm enough to help in maintaining the erect position.

CONCLUSIONS. It has been clearly shown that similar operations have been performed at different periods in previous centuries.

The operation, as simplified by the writer, has been performed in a large number of cases, upon which the paper is based.

An apparatus is described by which it is possible to accomplish the correction without the necessity of a large number of assistants, and which makes it possible to apply the plaster-of-Paris jacket with marked hyper-extension of the spine.

No unpleasant results have been experienced, and in the five cases in which paralysis was present the recovery was almost immediate.

In the acute beginning cases the operation seems to promise a moderate diminution of the existing deformity, and, with the method of after-treatment as advised, it is probable that the course of the disease will be shortened, and that the usual increase of the deformity will be avoided.

In cases in which there is marked deformity the operation is justifiable at times, in order to secure better respiratory and digestive action, as well as to improve the position of the spine. In these cases considerable relapse is to be expected, owing to the extensive destruction of the bones and the imperfect osseous repair which takes place in tubercular disease.

